RIVERS MANAGEMENT ADVISORY COMMITTEE
STRATEGY FOR STREAM GAGING IN NEW HAMPSHIRE
December 20, 2005

THE ISSUE

Stream gaging is monitoring of stream flow and its variation over time. This monitoring is fundamental to understanding and managing water resources to meet multiple objectives. These objectives include: prediction and estimation of the magnitude of floods and droughts; establishing and administering protected instream flows for aquatic life and recreation; managing water use and impoundment water levels for multiple purposes including but not limited to hydroelectric power generation, recreation, public water supply; agricultural and golf course irrigation; snowmaking; and industrial water use. Stream gaging data also feeds research into relations between weather, climate, watershed characteristics, and water flow and availability and quantifies a key component of the watershed water and nutrient budgets. Research and water budget analysis are the foundation of informed public policy and decision-making for comprehensive water resource management.

Adequate stream gaging is of particular concern for the Rivers Management and Protection Program established under RSA 483. The legislature through statute required that implementation of the instream flow protection provisions of this program be established through rules. These rules, now in the pilot phase, depend on stream gaging data.

As of the summer of 2005, the US Geological Survey (USGS) operated 47 stream gages in NH (http://nh.water.usgs.gov/WaterData/index.htm) both as part of a National Streamflow Information Program (http://water.usgs.gov/nsip/index.html) and under cooperative agreements with the NH Department of Environmental Services (DES) and others. In 2004 and 2005, state budget constraints resulted in the discontinuance of a total of 14 stream gages, at the same time as increased population and economic activity in many New Hampshire watersheds are increasing both water use and water-based recreation.

This strategy describes, in summary form, a vision for essential stream gaging activity in New Hampshire to support the understanding and management of our valuable water resources, and recommends creation of a New Hampshire Stream Gage Network administered by DES.

INSTITUTIONAL REALITIES

Although USGS intends to be the organization responsible for a unified, multi-purpose national Stream Gage Network[1], the fact is that Congress has consistently under funded the national network for identified federal interests, and has never funded stream gaging for state and local, watershed-level interests. In addition, although USGS provides excellent service in terms of

[1] "It is in the national interest to have a single integrated system to provide real-time and historical stream flow information for all users: water managers, emergency managers, recreational water users, engineers, and scientists.", Dr. Robert Hirsch, in a 2004 presentation on the US Geological Survey's stream gaging program.

methods, documentation, data availability, and quality control, per-gage costs for gage operations have risen approximately 50% in the past decade, as shown in the attached graph (source: USGS).

At DES, the Dam Bureau is responsible for operation and maintenance of stream gages. Historically, this has been done by cooperative agreement with USGS. Planning for stream gage placement and operation has been by informal consultation among the Dam Bureau, NH Geological Survey, and USGS. Income from leases of state-owned dams for hydropower generation has funded the cooperative agreements. In recent years, buy-out and termination of several leased hydropower projects have resulted in substantially decreased revenues at the same time as USGS per-gage costs have increased. These funding constraints have resulted in a decrease of 16 gages in the cooperative agreement, from 30 in 2003 to 14 in 2005, as shown in the attached graph (source: USGS).

The Rivers Management Advisory Committee believes these issues and realities call with some urgency for a strategy to implement and fund a long-term, multi-purpose New Hampshire Stream Gage Network.

GUIDING PRINCIPLES FOR A NEW HAMPSHIRE STREAM GAGE NETWORK

Planning for the network should use the guiding principles of the recently drafted New Hampshire Water Monitoring Strategy:

1) Water resource management decisions should be data-driven, and framed on a watershed basis.
2) The purpose for collecting water data should be clearly understood.
3) Water data should be accessible and interoperable, with documented data quality and metadata.

In addition to the principles in the NH Water Monitoring Strategy:

4) Water data should be of sufficient quality to function in legal decision-making processes.

1) Watershed Basis

Although watersheds come in all sizes and shapes, the recommended watershed units for strategic planning are six-digit Hydrologic Unit Codes. New Hampshire has four of these: Connecticut, Merrimack, Androscoggin, and Saco/Salmon Falls/Piscataqua.

2) Purposes

Purposes for collecting stream gage data may be grouped into three general categories:

a) Real-time operation and management of dams and water use, including flood control, hydropower generation, drought management, instream flow protection, recreational forecasts, and the like,

b) Flow estimation and simulation for modeling and design, including Total Maximum Daily Loads (TMDLs), flood elevation-frequency estimation, flood routing, sizing of hydraulic structures, and the like, and

c) Research and analysis of the relations among climate, watershed characteristics, human activity, and stream flow, including flow-frequency regression analysis, flow estimation from watershed attributes, and the like.

As additional strategic planning is conducted these purposes should be further defined and described, with input and comment from agencies, organizations and other interests that use the data, so that the purposes are sufficiently specified to prepare a network design.

Stream gages may be continuous, real-time reporting gages, continuous gages without real-time reporting, partial record low-flow gages, or partial record high-flow gages. The type and location will be dictated by the data purpose, and the practicalities of stream gage calibration, operation, and maintenance.

3) Data quality, documentation, accessibility, and interoperability

Stream gage data should be readily available in electronic form to identified data users as well as to the public. Data quality – precision, accuracy, and calibration records – should be documented and essential metadata should be provided electronically together with the data itself. No matter who collects and maintains the data, datasets should be easily compared and combined to suit analysis needs. This is done routinely for data collected and maintained by the USGS. For stream gage data collected by others – such as state agencies, educational institutions, volunteers – these issues should be worked out, with specified procedures and protocols for the New Hampshire Network.

NETWORK ADMINISTRATION AND FUNDING

Virtually all past stream gaging in New Hampshire has been done by USGS or under its umbrella. This may not be the case in the future. Not only are the costs of USGS services increasing, but the local watershed and state water management purposes for data collection at times do not align well enough with national priorities for USGS to participate in a major way. Therefore, DES, in collaboration with the USGS should develop a new format for some or all of the gaging network.

Substantial federal funding is problematic because New Hampshire Stream Gage Network priorities at times may not align well with national stream gaging priorities. Substantial state general funding is also a challenge because of the long-standing New Hampshire legislative practice of limited appropriations from general revenues for environmental programs.

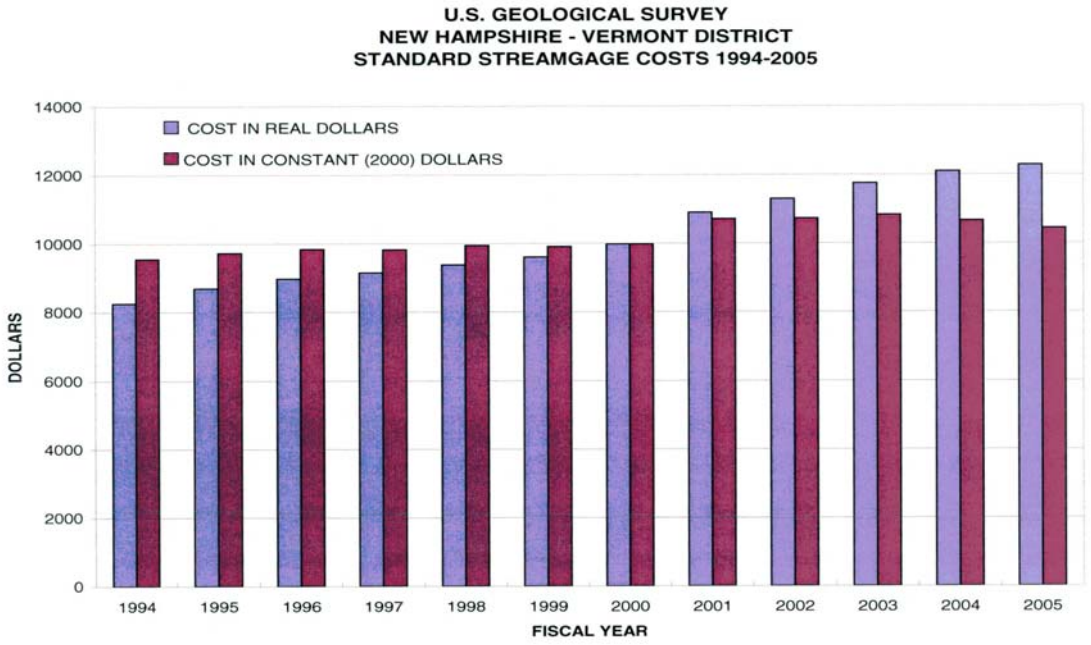
A prototype expanded network should be designed, operated, and maintained cooperatively by data users, with DES providing technical assistance, quality assurance and quality control, and data management at sites not likely to be funded or operated by the USGS. This would be done in cooperation with USGS, to the extent USGS is able to participate. After network design, stream gage installation and operation would be done by various users of water resources in consultation with other data users and stakeholders, these users would include: hydropower generators, water users and dam owners under water management plans, recreational interests for boating and kayaking, and so on. Installation and operation could also be done by watershed monitoring and stewardship organizations. All would be coordinated and administered by DES.

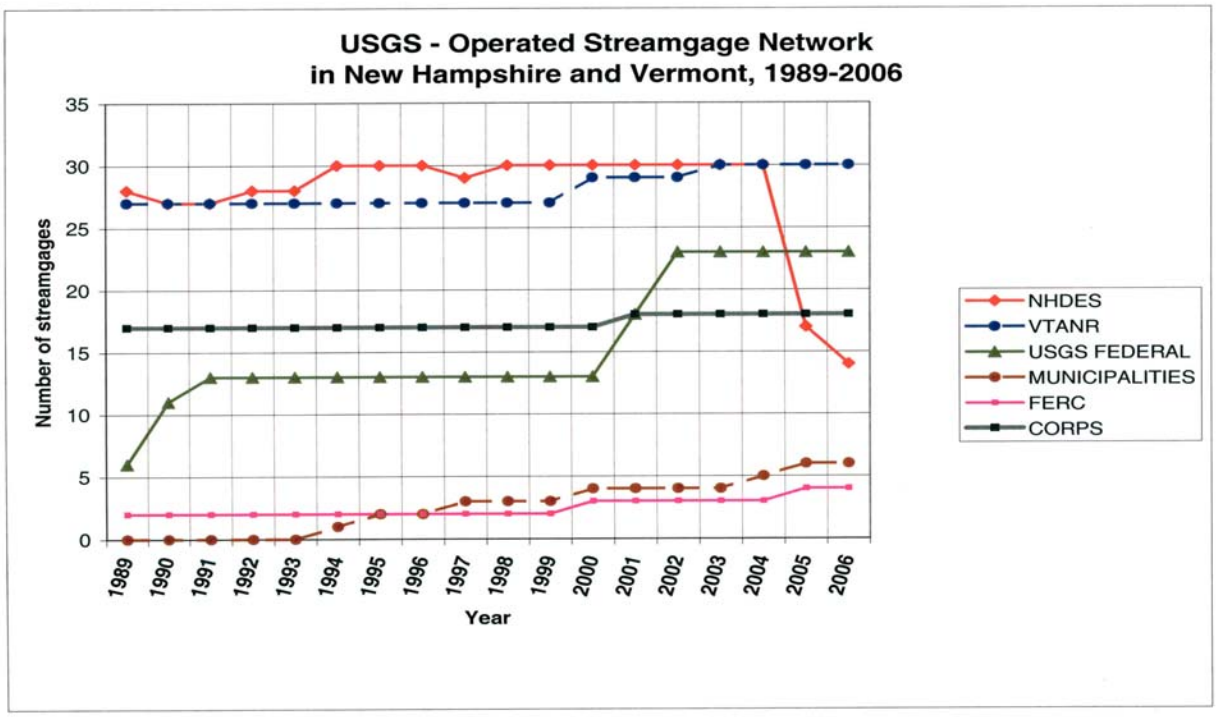
Funding is important, but details of funding options should wait, be worked out after all stakeholders are identified and participate in initial network design to the point where specific activities, responsibilities, and their costs can be identified.

GUIDING PRINCIPLES FOR CONTINUED FUNDING OF CURRENT HISTORIC USGS GAGES IN NH

The Rivers Management Advisory Committee, DES and USGS and other gage users need to develop, advocate for and achieve a more stable and long-term funding strategy with the NH Congressional delegation and the NH legislature to prevent the continued loss of USGS gages and to bring back on line the valuable gages already mothballed. This includes the need for not only the federal support but also the essential State of New Hampshire funding or user match. As more USGS gages are lost, it is not only the gages themselves but also the critical support capacity of USGS for all New Hampshire gages that becomes endangered.

An early action item in implementing the strategy should be an assessment of what existing USGS gages are the most critical and whether any old gages should be dropped or new gages added that meet both state and national objectives.


U.S. GEOLOGICAL SURVEY
NEW HAMPSHIRE - VERMONT DISTRICT
STANDARD STREAMGAGE COSTS 1994-2005
COST IN REAL DOLLARS
COST IN CONSTANT (2000) DOLLARS
DOLLARS
14000
12000
10000
8000
6000
4000
2000
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
FISCAL YEAR


USGS - Operated Streamgage Network
in New Hampshire and Vermont, 1989-2006
Number of streamgages
35
30
25
20
15
10
5
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NHDES
VTANR
USGS FEDERAL
MUNICIPALITIES
FERC
CORPS